

CLAIMS

Having described the invention that which is claimed is:

1. An article of manufacture containing a first chemical composition useful to treat a second chemical composition dissolved in an aqueous liquid in contact with the exterior surface of said article:

said article is a capsule comprised of a hollow interior, said first chemical composition enclosed in said hollow interior, and a membrane, permeable to said aqueous liquid, which maintains said first chemical composition in said hollow interior;

said membrane is comprised of at least a first material, a polyurethane-vinyl polymer dispersion prepared by the simultaneous polymerization of a vinyl monomer and chain extension of an isocyanate-terminated polyurethane prepolymer in the presence of water, which is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition or said aqueous liquid in contact with said exterior surface of said capsule; and

said first chemical composition is reactive with said second chemical composition, is soluble in said aqueous liquid in contact with said exterior surface of said capsule, is not reactive with, soluble in or a solvent for said first material, and is selected from, enzymes, and organic and inorganic acids, bases, salts and oxidizing agents.

2. The capsule of claim 1 wherein said first chemical composition is selected from the group consisting of medicines, pesticides, algaecides, herbicides, cosmetics, laundry products, pigments, polymerization initiators, cross linking agents, viscosity reducing agents and additives for adjusting the setting properties of hydraulic cement.

3. The capsule of claim 1 wherein said first chemical composition is a solid, water-soluble chemical composition having a particle size in the range of from about 10 to about 60 mesh US Sieve series.

891 4. The capsule of claim 1 wherein said first material is cross linked with agents selected
892 from polyaziridines, carbodiimides, epoxies and metal ion cross linkers.

893 5. The capsule of claim 1 wherein said first chemical composition is selected from alkali
894 and alkaline earth metal halides, oxides, hydroxides, carbonates, bicarbonates, perborates,
895 peroxides, percarbonates, bisulfates and persulfates.

896 6. A method for controlling the introduction of a first chemical composition into reactive
897 contact with a second chemical composition comprising:

898 introducing into an environment comprised of at least one aqueous liquid having said
899 second chemical composition dissolved therein, a capsule comprised of a hollow interior, said
900 first chemical composition enclosed in said hollow interior, and a membrane, permeable to said
901 aqueous liquid, which maintains said first chemical composition in said hollow interior, whereby
902 the exterior surface of said membrane is in contact with said aqueous liquid;

903 permitting said aqueous liquid to permeate said membrane to contact said first chemical
904 composition enclosed in said hollow interior to produce a solution of said first chemical
905 composition in said aqueous liquid; and

906 permitting said solution to permeate said membrane to contact said aqueous liquid in
907 contact with said exterior surface of said membrane to thereby place said first chemical
908 composition into reactive contact with said second chemical composition; wherein

909 said membrane is comprised of at least a first material, a polyurethane-vinyl polymer
910 dispersion prepared by the simultaneous polymerization of a vinyl monomer and chain
911 extension of an isocyanate-terminated polyurethane prepolymer in the presence of water, which
912 is not reactive with, soluble in or a solvent for said first chemical composition, said second
913 chemical composition or said aqueous liquid in contact with said exterior surface of said
914 capsule; and

said first chemical composition is reactive with said second chemical composition, is soluble in said aqueous liquid in contact with said exterior surface of said capsule, is not reactive with, soluble in or a solvent for said first material, and is selected from, enzymes, and organic and inorganic acids, bases, salts and oxidizing agents.

7. An article of manufacture containing a first chemical composition useful to treat a second chemical composition dissolved in an aqueous liquid in contact with the exterior surface of said article:

said article is a capsule comprised of a hollow interior, said first chemical composition enclosed in said hollow interior, and a membrane, permeable to said aqueous liquid, which maintains said first chemical composition in said hollow interior;

said membrane is a composite material comprised of a first material and a second material wherein said first material is a supporting matrix for said second material which is fixed in said supporting matrix;

said first material is a polyurethane-vinyl polymer dispersion prepared by the simultaneous polymerization of a vinyl monomer and chain extension of an isocyanate-terminated polyurethane prepolymer in the presence of water, and said first material is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition, said second material, or said aqueous liquid in contact with said exterior surface of said capsule;

said second material is different from said first material, is a particulate, and is not reactive with, soluble in or a solvent for said first chemical composition, said second chemical composition, said first material, or said aqueous liquid in contact with said exterior surface of said capsule;

said first chemical composition is reactive with said second chemical composition, is soluble in said aqueous liquid in contact with said exterior surface of said capsule, is not

940 reactive with, soluble in or a solvent for said first material or said second material, and is
941 selected from, enzymes, and organic and inorganic acids, bases, salts and oxidizing agents.

942 8. The capsule of claim 7 wherein said second material in the composite material is a
943 particulate solid having a particle size in the range of from about 1 to about 15 microns present
944 in the composite material in an amount in the range of from greater than about 0 to about 50
945 percent particulate solid by total weight of composite material.

946 9. The capsule of claim 7 wherein said second material is selected from silica, calcium
947 carbonate, titanium dioxide, barium sulfate, calcium sulfate and mixtures thereof.

948 10. The capsule of claim 7 wherein said first chemical composition is selected from alkali,
949 alkaline earth metal and ammonium halides, oxides, hydroxides, carbonates, bicarbonates,
950 perborates, peroxides, percarbonates, bisulfates, borates and persulfates.

951 11. The capsule of claim 7 wherein said first material is reacted with cross linking agents
952 selected from polyaziridines, carbodiimides, epoxies and metal ion cross linkers.

953 12. The capsule of claim 11 wherein said cross linking agent is admixed with said first
954 material and said second material in an amount in the range of from about 1 to about 5 per cent
955 cross linking agent by weight of said first material.

956 13. The capsule of claim 7 wherein said composite material is present in said capsule in an
957 amount in the range of from about 10 to about 50 percent of said composite material by weight
958 of said capsule.

959 14. The capsule of claim 7 further comprising a third material deposited on said composite
960 material as an overcoat.

961 15. A method for controlling the introduction of a first chemical composition into reactive
962 contact with a second chemical composition comprising:
963 introducing into an environment comprised of at least one aqueous liquid having said
964 second chemical composition dissolved therein, a capsule comprised of a hollow interior, said

965 first chemical composition enclosed in said hollow interior, and a membrane, permeable to said
966 aqueous liquid, which maintains said first chemical composition in said hollow interior, whereby
967 the exterior surface of said membrane is in contact with said aqueous liquid;
968 permitting said aqueous liquid to permeate said membrane to contact said first chemical
969 composition enclosed in said hollow interior to produce a solution of said first chemical
970 composition in said aqueous liquid; and
971 permitting said solution to permeate said membrane to contact said aqueous liquid in
972 contact with said exterior surface of said membrane to thereby place said first chemical
973 composition into reactive contact with said second chemical composition; wherein
974 said membrane is a composite material comprised of a first material and a second
975 material wherein said first material is a supporting matrix for said second material which is fixed
976 in said supporting matrix;
977 said first material is a polyurethane-vinyl polymer dispersion prepared by the
978 simultaneous polymerization of a vinyl monomer and chain extension of an isocyanate-
979 terminated polyurethane prepolymer in the presence of water, and said first material is not
980 reactive with, soluble in or a solvent for said first chemical composition, said second chemical
981 composition, said second material, or said aqueous liquid in contact with said exterior surface of
982 said capsule;
983 said second material is different from said first material, is a particulate, and is not
984 reactive with, soluble in or a solvent for said first chemical composition, said second chemical
985 composition, said first material, or said aqueous liquid in contact with said exterior surface of
986 said capsule; and
987 said first chemical composition is reactive with said second chemical composition, is
988 soluble in said aqueous liquid in contact with said exterior surface of said capsule, is not

989 reactive with, soluble in or a solvent for said first material or said second material, and is
990 selected from, enzymes, and organic and inorganic acids, bases, salts and oxidizing agents.

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